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## STUDY OF INFORMATION SECURITY IN THE SYSTEM OF INFORMATION AND ANALYTICAL SUPPORT OF FORMATION AND USE OF INTELLIGENT CAPITAL OF CONSTRUCTION ENTERPRISES

*Проведено аналіз існуючих теоретичних положень до визначення інформаційної безпеки у системі інформаційно-аналітичного забезпечення формування та використання інтелектуального капіталу. Визначені складові інформаційної безпеки у системі формування та використання інтелектуального капіталу будівельних підприємств: нормативно-правова, технічна, функціональна.*

**Ключові слова:** будівельні підприємства, інформаційно-аналітичне забезпечення, інформаційна безпека, формування та використання інтелектуального капіталу.

### 1. Introduction

In modern conditions, to ensure the development of construction enterprises, there is a need to rethink the approaches to its management. In such conditions, the direction of formation and use of the intellectual capital of construction companies, which in developed economic systems occupies 60–80 % of the business value, acquire special significance.

To ensure the effectiveness of the formation and use of the intellectual capital of construction enterprises, it is necessary to form information and analytical support for making sound management decisions.

In the context of development of information and analytical support for the formation and use of intellectual capital, information security as a system of protection from the influence of various groups of stakeholders and factors affecting the development of construction enterprises is of particular importance.

### 2. The object of research and its technological audit

With the purpose of effective formation and use of the intellectual capital of construction enterprises, the analysis of the construction market is carried out. A low level (about 5 %) of intellectual capital in domestic construction enterprises is determined.

International experience shows the need for the use of intellectual capital. In particular, the share of intellectual capital in the value of assets of US enterprises is 86 %, along with material resources – 14 %.

In the rating of construction companies in Europe there are no domestic enterprises, which indicate their low level of efficiency and investment attractiveness. Even the lowest in terms of sales of construction products companies in Europe significantly exceed sales volumes of the leaders of the domestic market. In such conditions, the development of measures and the introduction of mechanisms for increasing the efficiency of activities and the capitalization of domestic construction companies through the increase in the cost and use of intellectual capital become important.

In the ranking, the largest share belongs to the companies of Great Britain (20), Spain (11), Holland (10), Italy (9) and France (9) (Fig. 1). The results of the rating show that the companies of the represented countries significantly influence the formation of the construction market and determine its development at the present stage of economic transformation.

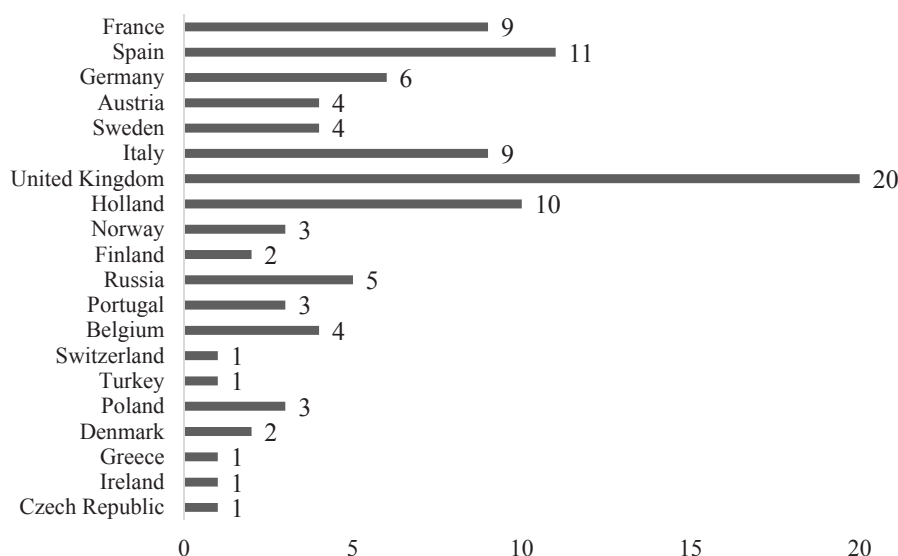


Fig. 1. The number of the largest construction companies in Europe (generalized by the author)

Consequently, in order to ensure the development of domestic construction enterprises and their transformation into international construction markets, increasing the effectiveness of the formation and use of intellectual capital by developing information and analytical support and ensuring its information security is of particular importance.

### 3. The aim and objectives of research

*The aim of research* is analysis of the existing theoretical provisions for the definition of information security in the system of information and analytical support for the formation and use of the intellectual capital of construction enterprises.

To achieve this aim, the following tasks are defined:

1. To characterize the importance of intellectual capital for development of enterprises.
2. To determine the level of formation and use of the intellectual capital of construction enterprises.
3. To systematize theoretical approaches to the definition of information security of information and analytical support for the formation and use of the intellectual capital of construction companies.
4. To determine the components of information security.
5. To propose recommendations for the creation and implementation of an information security system for information and analytical support for the formation and use of the intellectual capital of construction enterprises.

### 4. Research of existing solutions of the problem

Many scientists and practitioners are engaged in research on the directions of formation and determination of the effectiveness of the use of intellectual capital. In [1], the directions and peculiarities of the use of intellectual capital are investigated. The essence, content and priority directions of the effectiveness of the use of intellectual capital are analyzed in [2]. The determination of the special importance of intellectual capital and the indicators characterizing its use are considered in [3–6].

In work [7], the basic direction of formation of an intellectual capital of the enterprise is considered, which is characterized by the above-standard profit which the enterprise receives in the course of industrial-economic activity due to: competitive advantages; use of human, technological and market capital. Research [8] is devoted to the improvement of directions of formation and use of intellectual capital of construction enterprises by:

- improvement of the directions for determining intellectual capital;
- characteristics of its components, taking into account the peculiarities of its formation and use in construction enterprises;
- formation of information and analytical support in the assessment of intellectual capital;
- development and implementation of mechanisms for managing the intellectual capital of construction companies;
- formation of a strategy for development of intellectual capital;
- determination of directions of efficiency growth of formation and use of intellectual capital in construction enterprises.

However, the formation and use of the intellectual capital of construction enterprises requires constant research, precisely because in the current economic conditions there are constant transformations and changes in the external and internal environment, it requires improvement of the corresponding information and analytical support and solution of problems of information security implementation.

### 5. Methods of research

To solve the tasks, the following methods are used: analysis and synthesis, logical generalization, comparative comparison.

### 6. Research results

In the information and analytical support system for the formation and use of intellectual capital of construction enterprises for information security are the next components:

#### 1. Normative-legal:

1.1. The Constitution of Ukraine in which characterized the information security in the context of the most important functions of the state and the work of the entire Ukrainian people [9].

1.2. The Law of Ukraine «On the Fundamentals of National Security of Ukraine» defines the main priorities for the formation and implementation of information security in the context of ensuring national security of Ukraine [10].

1.3. The Doctrine of Information Security of Ukraine, where special attention is focused on the formation of a multi-level information security system, which includes the following directions:

- creation of an integrated system for assessing information threats and prompt response to them;
- improvement of the powers of state regulatory bodies that carry out activities on the information space of the state;
- legislative regulation of the mechanism for identifying, fixing, blocking and removing from the information space of the state, in particular from the Ukrainian segment of the Internet, information threatening the life and health of citizens of Ukraine, propagandizes war, national and religious hostility, alteration of the constitutional system by violent means or violation of territorial integrity Ukraine, threatens state sovereignty, promotes communist and/or national-socialist (Nazi) totalitarian regimes and their symbolism;
- determination of mechanisms for regulation of work of the enterprises carrying out information support;
- prohibition of the operation of radio transmitting and receiving personal and collective use and transmission of information through computer networks in the conditions of the introduction of the legal regime of martial law;
- optimization of legislative mechanisms for the implementation of Ukraine's obligations under the European Convention on Transfrontier Television in relation to States that are not signatories to this Convention;
- creation and development of structures responsible for information and psychological security;
- development and protection of technological infrastructure ensuring information security of Ukraine;

- ensuring full coverage of the territory of Ukraine by digital broadcasting;
- development of digital broadcasting;
- building an effective system of strategic communications;
- development of mechanisms for interaction between the state and civil society institutions in countering information aggression against Ukraine;
- combating misinformation and destructive propaganda;
- strengthening the capabilities of the security and defense sector to counteract special information operations aimed at changing the constitutional system by violent means, violating sovereignty and territorial integrity, undermining the defense capability of Ukraine, demoralizing the personnel of the Armed Forces of Ukraine and other military formations, exacerbating the socio-political situation;
- identification and bringing to responsibility in accordance with the legislation of the subjects of the Ukrainian information space;
- impossibility of free circulation of information products, reducing the level of information security;
- preventing the use of the information space of the state for destructive purposes or for actions aimed at discrediting Ukraine at the international level, etc. [11].

1.4. The Law of Ukraine «On Information» [12] defines the need to implement information security in the construction and implementation of the information system and the creation of information and analytical support for the formation and use of intellectual capital of construction enterprises.

1.5. The Law of Ukraine «On the National Informatization Program», which justifies the formation of a set of information processes with the use of computer facilities that provide high data processing speed, quick information retrieval, data dispersal, access to information sources regardless of their location [13].

2. Technical component includes:

2.1. Directions for the formation of technical protection of information, which are characterized by the definition and analysis of threats, the development of information security systems; implementation of the information protection plan; monitoring the functioning and management of the information security system [14].

2.2. The directions of the implementation of technical protection of information are determined by the implementation of a unified technical policy, the creation and development of a single terminological system; the formation of multi-level information security systems based on mutually agreed provisions, rules, methods, requirements and norms, the development and implementation of certification systems, licensing and certification in accordance with information security requirements, the development of services in the system of technical protection of information, the establishment of the development, production, technical protection of information and special control and measuring equipment, organization of design of construction works for technical protection of information, the development of human capital in technical information protection system [14].

2.3. Influence on information leakage channels is carried out on the basis of the formation and implementation of technical measures to block the leakage of information through:

- different groups of stakeholders interacting in the sphere of formation and use of the intellectual capital of construction enterprises;
- radio channels;
- acoustic;
- electrical;
- visual-optical;
- material.

2.4. Individual technical information protection includes systems:

- delineation and access of information;
- personification;
- identification and authentic conformity;
- audit and monitoring;
- anti-virus protection.

2.5. Communicative information protection systems are formed and implemented on the basis of application:

- tools for blocking information attacks from the external and internal environment of the construction company (Cisco PIX Firewall, Symantec Enterprise Firewall™, Contivity Secure Gateway and Alteon Switched Firewall from Nortel Networks);
- technical means from unauthorized and unjustified influence on information flows and networks (Cisco Secure IDS, Intruder Alert and NetProwler from Symantec);
- tools for creating secure channels by building virtual private networks (Symantec Enterprise VPN, Cisco IOS VPN, Cisco VPN concentrator), means of detection of information sources, analysis of directions of information threats (Symantec Enterprise Security Manager, Symantec NetRecon).

2.6. Complex software and hardware means of information protection include components:

- tools to protect against unauthorized access to information on the formation and use of intellectual capital of construction enterprises (authorization tools, mandatory access control, access control by means of role definitions, selective access control and information audit);
- tools for analysis and modeling of information external and internal flows (CASE systems);
- monitoring tools of information protection;
- tools to protect the sources of confidential information (DLP system);
- instruments analysis tools;
- antiviral means;
- internetwork information protection tools;
- cryptographic means by encryption of information and use of digital signature;
- tools for reserving information by performing backups, creating a failover cluster;
- uninterruptible power tools (UPS, backup power lines, power generators);
- tools based on the development and implementation of passwords, access keys, certificates, biometrics;
- security issues tools developed based on the use of protection against physical and information hacking of premises and information systems, control and management of access to information, tools for analysis of protection systems.

3. Functional component includes:

3.1. Counteraction to information confrontation is characterized by the use of tools from the influence on the

systems of formation, processing, dissemination and storage of enemy information, the application of measures to protect information systems from external and internal threats.

3.2. The prevention or counteraction to information wars is characterized by the formation of the system and the use of tools to comprehensively influence the enemy's information environment to provide information advantages.

3.3. Counteraction to violations of the system for the formation and use of information is carried out through the definition and application of information technical tools and organizational forms to counter violations:

- illegal collection, storage, processing, dissemination of information;
- hiding information;
- untimely provision of information;
- misrepresentation, distribution of inaccurate information;
- use of information of socially harmful content;
- unauthorized access to confidential information;
- use of information with limited access;
- implementation of destructive information impact on a person's consciousness;
- creation, use, distribution of malicious software;
- illegal access, use of systems for processing, storing, transferring information;
- unauthorized interference, obstruction of the operation of information and telecommunication systems and their components [15].

## 7. SWOT analysis of research results

*Strengths.* The strength of research is an analysis of existing theoretical provisions for the construction of an information security system for information and analytical support for the formation and use of the intellectual capital of construction enterprises. Particular importance has certain components of information security.

*Weaknesses.* The weak side in the conducted research is the level and peculiarities of interaction between the components of information security of information and analytical support for the formation and use of the intellectual capital of construction enterprises. In addition, the practical aspects of implementing information security are not disclosed, taking into account the features of the functioning of construction enterprises.

*Opportunities.* The opportunities for further research are borrowing the experience of foreign countries in creating information security of information and analytical support for the formation and use of intellectual capital of construction enterprises, using technical and technological tools.

*Threats.* The threats to the results of the conducted studies are that the construction market is permanently changing and influenced by internal and external factors. This creates conditions for the braking of the directions of formation and use of the intellectual capital of construction enterprises.

## 8. Conclusions

1. An importance of intellectual capital, which in developed economies takes 60–80 % of the value of business, is identified. The share of intellectual capital in the value of US businesses is 86 %, along with material resources – 14 %.

2. The low level of formation and use of intellectual capital in domestic construction enterprises is established. This is due to the low level of information and analytical support for its formation and use, the impact of external and internal factors.

3. Theoretical approaches to the definition of information security of information and analytical support for the formation and use of the intellectual capital of construction enterprises are investigated.

4. The components of information security are defined, which determine the regulatory legal, technical and functional elements.

5. The recommendations on the creation and implementation of the information security system of information and analytical support for the formation and use of the intellectual capital of construction companies are proposed, which consist in the development of a mechanism for managing the flow of information flows, ensuring interaction between groups of stakeholders operating in the presented field, applying modern methods, models, tools for information security.

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**ИССЛЕДОВАНИЕ ИНФОРМАЦИОННОЙ БЕЗОПАСНОСТИ В СИСТЕМЕ  
ИНФОРМАЦИОННО-АНАЛИТИЧЕСКОГО ОБЕСПЕЧЕНИЯ  
ФОРМИРОВАНИЯ И ИСПОЛЬЗОВАНИЯ ИНТЕЛЛЕКТУАЛЬНОГО  
КАПИТАЛА СТРОИТЕЛЬНЫХ ПРЕДПРИЯТИЙ**

Проведен анализ существующих теоретических положений к определению информационной безопасности в системе

информационно-аналитического обеспечения формирования и использования интеллектуального капитала. Определены составляющие информационной безопасности в системе формирования и использования интеллектуального капитала строительных предприятий: нормативно-правовая, техническая, функциональная.

**Ключевые слова:** строительные предприятия, информационно-аналитическое обеспечение, информационная безопасность, формирование и использование интеллектуального капитала.

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